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BULLETIN No. 216

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THE COST OF MILK PRODUCTION  
COMPUTED ON THE YEAR BASIS

By F. A. PEARSON



URBANA, ILLINOIS, APRIL, 1919



## SUMMARY OF BULLETIN No. 216

**INTRODUCTION.**—In studies pertaining to the cost of producing milk, a clear distinction must be made between milk produced for city trade and that produced for manufacturing purposes. The present study is confined to milk produced for direct consumption by the city trade. Page 343

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**THE DAIRY HERD AS THE UNIT.**—With the herd as the basis of calculation, the aggregate value of 2.42 hours of man labor, 44 pounds of grain, 50 pounds of hay, 188 pounds of silage, and 39 pounds of other roughage approximately equaled in the present study, the net year cost of producing one hundred pounds of milk. Page 346

Prices of whole milk, however, cannot be constant thruout the year. A more or less satisfactory method for apportioning costs among the various months of the year is to use as a basis the percentage spread in the price paid for milk in the past. Page 356

**THE COW AS THE UNIT.**—With the cow as the basis for calculating the cost of milk production, only the expense of maintaining the mature cows and bulls and the returns from them are involved. In the present study the net cost of producing one hundred pounds of milk on this basis was found to approximate the value of 35 pounds of grain, 36 pounds of hay, 140 pounds of silage, 29 pounds of other roughage, and 2.36 hours of labor; plus 25.4 percent. Page 357

**CONCLUSIONS**

Page 364

### Acknowledgment

Credit for the initiation of the studies of which this bulletin is a part, is due W. J. Fraser, Professor of Dairy Farming. His interest having been strongly drawn to the economic side of dairy farming, he early became convinced of the need of accurate studies in the cost of milk production, and in 1912 Mr. R. E. Brand was placed in charge and Mr. Pearson was secured to assist in these investigations. Since 1914 Mr. Pearson has been in charge. The present publication is the first resulting from this series of investigations.

Recognition should also be given Messrs. Frank Turner and H. K. Rulison for their conscientious application in the collection of the data for the cow and herd cost of milk production and for their constructive suggestions.

# THE COST OF MILK PRODUCTION

## COMPUTED ON THE YEAR BASIS

BY F. A. PEARSON, ASSOCIATE IN DAIRY HUSBANDRY

### INTRODUCTION

This bulletin reports the results of investigations into the cost of producing whole milk for city consumption, with 56 percent of the total produced during the winter months. It has no relation to the cost of producing summer milk primarily for buttermaking or to the cost of the surplus from general farming.

Altho the business of dairying appears relatively simple, it is in reality one of the most complicated types of American farming, and the problems encountered in attempting to ascertain the actual cost of production are difficult to solve. Much confusion has arisen from the fact that the difference in the cost of producing milk for city trade and producing it for manufacturing purposes has not been sufficiently recognized, and also from the fact that the different methods of computation used have made impossible the accurate comparison of the studies of different investigators.

Milk produced for urban consumption usually sells for more than it is worth for manufacturing purposes. Milk used for manufacturing purposes may be produced far from market, on pasture, which is the cheapest feed, and the finished product may be stored for winter use. Owing to the fact that whole milk is bulky and perishable, it must be produced relatively near the cities, where feeds are more expensive than in districts more remote. Furthermore, a larger proportion must be produced in the winter months than is the case with milk for manufacturing purposes. This also leads to more expensive production, since feeds are more expensive in the winter than in the summer months.

The greater part of the dairy products sold from the farm are used for manufacturing purposes rather than for direct consumption in the form of whole milk by the urban population. The dairy products used for manufacturing purposes are usually produced from small herds where dairying is a side issue to the other farm activities.

The production of milk for direct consumption is generally restricted to the more or less intensive dairying districts adjacent to the larger cities and forms the greater proportion of the total farm business.

Since Chicago is the largest urban center within the state and the second largest milk-consuming city of the country, it was deemed advisable to make certain detailed, cost-accounting studies pertaining to the production of milk in the surrounding dairy districts.

Most of the data thus far published have been expressed in terms of dollars and cents. As values are constantly changing, much of the work has not fulfilled its original purpose. In order, if possible, to eliminate the restrictions placed upon a study by fluctuating values, it was thought best to express the results of this investigation in terms of commodities whenever possible.

### BASES OF CALCULATION

There are at least three bases upon which the cost of producing milk may be calculated: namely, the farm, the herd, and the cow. From the data secured for the present study it is possible to calculate costs from each of these various points of view.

By "farm cost" of milk production is meant the cost obtained by a method in which all farm receipts other than those from milk are deducted from the total farm expenses, leaving the remaining expenses to represent the cost of milk production. In case the receipts other than those from milk are almost negligible, this appears to be a satisfactory method; but the fact is that under the conditions of dairy farming in Illinois there are large receipts derived from sources other than milk. To use this "farm cost" method would in some cases be no more legitimate than for a railroad to find the cost of hauling passengers by deducting from the total expense of operating the railroads all receipts other than those for hauling passengers.

By "herd cost" of milk production is meant the cost obtained by a method in which the herd is made the basis of calculation and the cattle raising that accompanies the dairying is included in the cost accounting. One objection to this method is that the amount of feed which goes into milk production cannot be ascertained separately from that which goes into growing stock. As the value of the young stock tends in general to increase rapidly with age and the milking stock in general depreciates with age, the aggregate amount of appreciation will depend upon the ratio of the number of young stock to milch cows.

By "cow cost" of milk production is meant the cost obtained by a method in which the cow is the unit and credit is given for the value of the calves when dropped but the raising of the young stock is made a separate part of the business. The depreciation in the value of the milch cows becomes an expense of production.

One advantage of the cow cost is that it permits a comparison of results secured on different farms in the same or in different regions,



or of the same farms or different farms in different years. The disadvantage of the herd cost lies in the fact that the amount of young stock kept varies, and comparisons are therefore difficult to make.

### SOURCE OF DATA

The data presented showing the *farm cost* of milk production were secured in several townships in Kane and McHenry counties in 1911-12, and are based on the records of 680 typical dairy farms having a total of 19,802 cows producing for sale 104,516,900 pounds of milk. The average amount of milk sold per cow was 5,279 pounds. Of this, 57 percent was produced during the six winter months and 43 percent during the six summer months.

The data for *herd cost* were secured from 36 farms located in the fluid milk district tributary to Chicago. They do not involve any of the farms from which the data for the study of the farm cost were secured. The 36 farms had a total of 873 cows producing during the fiscal years 1914-15 and 1915-16, 5,683,992 pounds of milk containing 205,415 pounds of fat. The average milk sold per cow during the period was 6,511 pounds. This milk contained 235 pounds of fat, testing 3.61 percent. Fifty-six percent was produced during the six winter months and 44 percent during the remainder of the year.

The data for *cow cost* were secured from 16 of the farms from which the data concerning herd cost were obtained. These 16 farms had a total of 428 cows producing, during the years 1914-15 and 1915-16, 2,924,164 pounds of milk containing 104,144 pounds of fat. The cows produced on an average 6,832 pounds of milk and 243 pounds of fat. The average percentage of butter fat in the milk was 3.56. Fifty-six percent of the milk was produced in the six winter months and 44 percent in the six summer months.

### THE FARM AS THE UNIT

Many persons insist that the farmer should have but one profit in dairy farming, and that the farm is the real unit on which the cost of milk production should be calculated. The farmer's business, however, is more complicated than is generally realized, and, altho not so large as many urban industries it is often more complex. The hog industry, the poultry industry, the dairy industry, and the individual crop industries are all separate and distinct parts of farm administration, and each may properly show a profit.

Using the data secured from the 680 dairy farms in Kane and McHenry counties, it is possible to determine the approximate farm cost of the milk which they produced. Table 1 shows this method of determining the cost of milk production.

TABLE 1.—THE FARM COST OF MILK PRODUCTION

As Secured from 680 Dairy Farms in Kane and McHenry Counties, Having a  
Total of 19,802 Cows Producing 1,045,169 Hundredweight  
of Milk: 1911-12

Items of expense and return	Amount	Per farm	Per cwt.
Total cash outlay, depreciation, and unpaid labor.....	\$1 692 675	\$2 489	\$1.62
Interest on operating capital at 5 percent.....	132 457	195	.13
<sup>1</sup> Rent of land and buildings.....	380 316	559	.36
<sup>2</sup> Farmer's labor.....	408 000	600	.39
Total expense.....	\$2 613 448	\$3 843	\$2.50
<sup>3</sup> Receipts other than for milk.....	1 120 202	1 647	1.07
Farm cost of production.....	\$1 493 246	\$2 196	\$1.43

<sup>1</sup>The rent charged is the current rate paid for cash rented land.

<sup>2</sup>The farmers' labor is estimated at \$600, which is the equivalent of hired men's wages.

<sup>3</sup>The receipts other than those for milk include those from crops and live stock sold, increase in value of inventory, and receipts for miscellaneous products.

The cost of production, as shown by this method of calculation, was \$1,493,246 for the community, \$2,196 per farm, and \$1.43 per hundredweight of milk. The cash received for this milk totaled \$1,664,931 for the community; \$2,448 per farm; and \$1.60 per hundredweight.

If the farms studied sold nothing but milk, the farm cost might be an accurate method of determining the cost of producing the milk. But according to this method, the farmer would, for example, make no profit on his hogs in a good year and suffer no loss on his corn crop if the community suffered from a drouth, for all losses or gains from the various enterprises would be expressed in terms of milk. On farms with a variety of income it would be just as consistent to analyze the cost of egg production in this way as to use it to determine the cost of milk production. The farms studied were in a very intensive dairy district, and yet only 58 percent of the receipts were derived from the sale of milk.

## THE DAIRY HERD AS THE UNIT

When the herd is used as the unit for studying the cost of milk production, the expense of rearing young stock is included in the cost. The total expense of maintaining the herd involves eight items: feed, man labor, interest on live stock, horse labor, use of dairy equipment, use of buildings, and miscellaneous charges. The total credits to the herd involve receipts from milk sold, milk consumed by the family, increase in stock, manure, and miscellaneous receipts.

## EXPENSES

## FEED

On the thirty-six farms studied from the standpoint of the herd cost of milk production, feed constituted about two-thirds (66.05 per cent) of the total expense of maintaining the herd. In the following tables the farm-raised feeds are charged to the dairy herd at prevailing farm values, while purchased feeds are charged at the purchase

TABLE 2.—AMOUNT AND VALUE OF GRAIN FED TO 873 COWS, 35 BULLS, AND 225 YOUNG STOCK IN THE PRODUCTION OF 5,683,992 POUNDS OF MILK CONTAINING 205,415 POUNDS OF FAT

Grain	Value	Weight in pounds	Value per cwt.	Value per cwt. of milk	Amount fed per cwt. of milk, in pounds
Corn.....	\$7 799.96	817 777	\$0.95	\$0.1373	14.3874
Malt.....	5 029.65	368 284	1.36	.0885	6.4793
Bran.....	3 206.29	264 664	1.21	.0564	4.6563
Oats.....	2 812.05	222 596	1.26	.0495	3.9162
Gluten.....	2 350.04	157 432	1.49	.0413	2.7697
Ajax.....	1 858.35	109 344	1.70	.0327	1.9237
Cottonseed meal....	1 495.69	96 759	1.55	.0263	1.7023
Barley.....	1 150.92	79 194	1.45	.0203	1.3933
Oil meal.....	779.59	44 775	1.74	.0137	.7877
Victor.....	674.15	47 489	1.42	.0119	.8355
White Diamond....	665.45	47 700	1.40	.0117	.8392
Middlings.....	547.37	43 110	1.27	.0096	.7584
Dairy feed.....	467.78	32 600	1.43	.0082	.5735
R. K. D.....	443.45	31 840	1.39	.0078	.5602
Hominy.....	340.87	25 290	1.35	.0060	.4449
Sugar feed.....	278.63	20 475	1.36	.0049	.3602
Calf meal.....	192.91	5 010	3.85	.0034	.0881
Germ meal.....	179.99	12 000	1.50	.0032	.2111
Empire.....	124.62	11 725	1.06	.0022	.2063
Unicorn.....	104.20	5 900	1.77	.0018	.1038
Shumacker.....	82.15	5 600	1.47	.0014	.0985
Rye.....	62.25	4 980	1.25	.0011	.0876
Climax.....	44.50	3 600	1.24	.0008	.0633
Akermane.....	40.30	2 660	1.52	.0007	.0468
Buckwheat middlings.....	39.72	4 965	.80	.0007	.0874
Tip Top.....	36.40	3 000	1.21	.0006	.0528
Chicago.....	34.50	3 375	1.02	.0006	.0594
Oat meal.....	17.45	670	2.60	.0003	.0118
Rye bran.....	16.75	1 275	1.31	.0003	.0224
Sucrene.....	14.40	800	1.80	.0003	.0141
Purina.....	13.50	1 200	1.12	.0002	.0211
H B.....	13.00	1 000	1.30	.0002	.0176
Molasses.....	9.50	675	1.41	.0002	.0119
B K.....	9.60	600	1.60	.0002	.0106
Sherwood.....	9.09	625	1.45	.0002	.0110
Cowpeas.....	4.40	440	1.00	.0001	.0077
Special.....	2.70	200	1.35	.0001	.0035
Blood meal.....	1.20	80	1.50	.00002	.0014
Oat bran.....	.73	100	.73	.00001	.0018
Total.....	\$30 954.10	2 479 809	\$1.248	\$0.54473	43.6279



price. The labor of delivering these feeds to the farm appears under the items horse labor and man labor. The pasture is charged to the stock at the prevailing cash rates in the districts studied.

*Grain.*—The 873 cows and 148 other cattle units<sup>1</sup> involved in the production of the milk on these farms consumed 2,479,809 pounds of grain valued at \$30,954.10. This grain represents in value more than one-third (36.6 percent) of the total feed given to the herd.

The kinds and amounts of grain fed are shown in Table 2. Of the total feeds classified as grain, the purchased feeds represent in value about three-fifths (61.8 percent) and the farm-raised feeds about two-fifths (38.2 percent).

The Illinois dairyman feeds more farm-raised grains than the eastern dairyman. A. L. Thompson<sup>2</sup> reports that 98 percent of the value of grains fed to cows on 174 farms in New York in 1912 was purchased and 2 percent farm raised. In Illinois corn is the most important grain, either raised or purchased, which is fed to dairy cows.

*Hay.*—In Table 3 are presented the amounts and weights of the various hays fed to the dairy herds. This class of feed represents in value about one-fifth (22.1 percent) of the total feed. Alfalfa, clover, timothy, and mixed hay formed the major portion of the feeds classified as hay.

The consumption of hay per hundredweight of milk was 50.16 pounds. This hay is valued at 65.6 cents per hundredweight, which leads to a cost of 33 cents for hay per hundredweight of milk produced.

TABLE 3.—AMOUNT AND VALUE OF HAY USED IN THE PRODUCTION OF 5,683,992 POUNDS OF MILK (ETC.)

Hay	Value	Weight in pounds	Value per cwt.	Value per cwt. of milk	Amount fed per cwt. of milk, in pounds
Alfalfa.....	\$10 687.43	1 545 095	\$0.69	\$0.1879	27.1833
Clover hay.....	2 885.49	479 300	.60	.0508	8.4324
Timothy hay.....	2 445.60	355 145	.69	.0430	6.2482
Mixed hay.....	2 444.38	411 725	.59	.0430	7.2436
Millet hay.....	66.00	16 000	.41	.0012	.2815
Barley hay.....	32.00	8 000	.40	.0006	.1407
Oat hay.....	24.00	4 000	.60	.0004	.0704
Oat and pea hay...	60.00	10 000	.60	.0011	.1759
Pea hay.....	30.00	6 500	.46	.0005	.1144
Wild hay.....	38.00	15 400	.25	.0007	.2709
Total.....	\$18 712.90	2 851 165	\$0.656	\$0.3292	50.1613

<sup>1</sup>One cow, one bull, or two head of young stock are considered a cattle unit. Two hundred and twenty-five young stock and 35 bulls are equivalent to 148 cattle units.

<sup>2</sup>Thompson, A. L. Cost of Producing Milk on 174 Farms in Delaware County, New York. Agr. Exp. Sta., Cornell University. Bul.364, page 124. 1915.

*Succulent Feeds.*—Silage, green corn, and hays which were cut and fed green are classified as succulent feeds. These feeds represent in value one-fourth (25.8 percent) of the total feeds used. In Table 4 are shown the amounts and values of these feeds.

TABLE 4.—AMOUNT AND VALUE OF SUCCULENT FEEDS USED IN THE PRODUCTION OF 5,683,992 POUNDS OF MILK (ETC.)

Succulent feed	Value	Weight in pounds	Value per cwt.	Value per cwt. of milk	Amount fed per cwt. of milk, in pounds
Silage.....	\$20 836.84	9 940 800	\$0.21	\$0.3665	174.8911
Green alfalfa.....	60.00	20 000	.30	.0011	.3519
Wet hay.....	2.00	400	.50	.00004	.0070
Green oat hay.....	20.00	10 000	.20	.0004	.1759
Green corn.....	929.00	712 600	.13	.0163	12.5370
Total.....	\$21 847.84	10 683 800	\$0.204	\$0.38434	187.9629

*Other Roughage.*—In the present study it was difficult to distinguish between corn stalks and corn fodder used as bedding and that used as feed. Many farmers feed the cows corn stalks and fodder, and after the edible portion is consumed the remainder is pushed back under the cows for bedding. In Table 5 are presented the amounts and values of these commodities so far as it was possible to classify them.

TABLE 5.—AMOUNT AND VALUE OF "OTHER" ROUGHAGE USED IN THE PRODUCTION OF 5,683,992 POUNDS OF MILK (ETC.)

Roughage	Value	Weight	Value per cwt.	Value of feed per cwt. of milk	Amount fed per cwt. of milk, in pounds
Corn fodder.....	\$3 642.21	1 478 430	\$0.25	\$0.0641	26.0100
Oat straw.....	1 344.27	636 370	.21	.0237	11.1958
Wheat straw.....	94.25	37 500	.25	.0017	.6597
Barley straw.....	77.75	33 000	.24	.0014	.5806
Clover straw.....	35.00	30 000	.12	.0006	.5278
Timothy straw.....	29.00	11 400	.25	.0005	.2006
Rye straw.....	10.00	4 000	.25	.0002	.0704
Shavings.....	6.00	10 000	.06	.0001	.1759
Total.....	\$5 238.48	2 240 700	\$0.234	\$0.0923	39.4208

*Pasture.*—Pasture represents but 8 percent of the total value of the feed consumed by the thirty-six herds. Table 6 shows the various classes of pasture and the value of each.

The blue-grass pasture constituted 84.4 percent of the value of the total pasture. The other pastures classified as oat stubble, wheat stubble, barley stubble, and corn stalks represent largely gleanings and a little volunteer grass or new seedings. Timothy, alfalfa, clover,

TABLE 6.—VALUE OF PASTURE USED IN THE PRODUCTION OF 5,683,992 POUNDS OF MILK (ETC.)

Pasture	Value	Value per cwt. of milk
Blue grass.....	\$5 738.06	\$0.10095
Oat stubble .....	233.00	.00410
Clover.....	203.86	.00359
Corn stalk.....	174.80	.00308
Timothy.....	166.50	.00293
Alfalfa.....	129.80	.00228
Mixed hay.....	97.50	.00172
Wheat stubble.....	40.00	.00070
Barley stubble.....	12.00	.00021
Total.....	\$6 795.52	\$0.11956

and mixed-hay pastures usually come after the crops have been cut. Altho the pastures other than blue grass represent but 15.6 percent of the total value of all pasture, they are of considerable importance, for they come at different periods thruout the pasture season and enable the farmer to rotate his fields. These stubble fields and cut-over hay fields form excellent pasture for short periods when the blue grass is dried up.

*Miscellaneous Feeds.*—These represent in value less than 2 percent of the total feed. In Table 7 are shown the amount and value of each. The skim milk, which was purchased, was the most important item.

TABLE 7.—AMOUNT AND VALUE OF MISCELLANEOUS FEEDS USED IN THE PRODUCTION OF 5,683,992 POUNDS OF MILK (ETC.)

Feed	Value	Weight in pounds	Value per cwt.	Value per cwt. of milk	Amount fed per cwt. of milk, in pounds
Skim milk.....	\$826.91	315 373	\$0.26	\$0.0145	5.5484
Wet malt.....	161.82	40 405	.40	.0028	.7109
Cottonseed hulls....	16.21	5 650	.29	.0003	.0994
Total.....	\$1 004.94	361 428	....	\$0.0176	.....

*Feed Summary.*—The total amounts and value of all feed and forage entering into the production of the milk from the thirty-six farms under discussion, are summarized in Table 8.

The total feed required to produce the 5,683,992 pounds of milk is valued at \$84,553.78, or \$1.49 per hundredweight of milk.



TABLE 8.—SUMMARY OF ALL FEEDS FED TO 873 COWS, 35 BULLS, AND 225 YOUNG STOCK IN THE PRODUCTION OF 5,683,992 POUNDS OF MILK CONTAINING 205,415 POUNDS OF FAT

Feed	Value	Weight in pounds	Value per cwt. of milk	Amount fed per cwt. of milk, in pounds
Grain.....	\$30 954.10	2 479 809	\$.5447	43.63
Succulent feeds.....	21 847.84	10 683 800	.3843	187.96
Hay.....	18 712.90	2 851 165	.3292	50.16
Other roughage.....	5 238.48	2 240 700	.0922	39.42
Pasture.....	6 795.52	.....	.1196	.....
Skim milk.....	826.91	315 373	.0145	5.54
Other feeds.....	178.03	46 055	.0031	.81
Total.....	\$84 553.78	.....	\$1.4876	.....

### LABOR

Next to feed, man labor is the most expensive factor entering into the production of milk. It includes the time spent in milking, in feeding, cleaning out barns, hauling feed, hauling milk, etc. Horse labor includes the time spent in hauling milk and feed, etc.

Man labor and horse labor do not include labor required in the production of crops or in the maintenance of other live stock.

TABLE 9.—NUMBER OF HOURS AND VALUE OF LABOR USED IN THE PRODUCTION OF 5,683,992 POUNDS OF MILK (ETC.)

Kind of labor	Value	Number of hours	Rate per hour in cents	Value of labor per cwt. of milk	Hours of labor per cwt. of milk
Man.....	\$21 750.12	137 792.25	15.7847	\$0.3826	2.4240
Horse.....	4 408.79	28 225.00	15.6200	.0776	.4965

In the data presented (Table 9) man labor represents 17 percent of the total expense of producing milk and horse labor 3 percent. The average cost of man labor was 15.78 cents per hour, and 2.42 hours were required to produce one hundred pounds of milk. The average rate per hour for the horse labor was 15.6 cents, one-half hour of which was necessary in the production of one hundred pounds of milk.

### EQUIPMENT

The dairy equipment includes milking machines, milk carts, pails, strainers, can scales, etc. The cost of the dairy equipment constituted less than 2 percent (1.27 percent) of the total expense of producing the milk, and amounted on the average to about 3 cents per hundred-weight of milk.

Depreciation represents 54 percent of the total equipment cost, and about one-fifth (20.59 percent) of the value of the equipment

TABLE 10.—TOTAL COST OF DAIRY EQUIPMENT USED IN THE PRODUCTION OF 5,683,992 POUNDS OF MILK (ETC.)

Value of equipment at beginning of the period . . .	\$4 288.02	
New equipment . . . . .	2 133.57	
Initial inventory and purchases . . . . .		\$6 421.59
Value of equipment at end of period . . . . .	\$5 150.76	
Equipment sold . . . . .	388.10	
Final inventory and sales . . . . .		5 538.86
Depreciation . . . . .		<u>\$882.73</u>
Repairs . . . . .	\$494.70	
Taxes . . . . .	8.44	
Interest on average value of equipment (\$4,719.35 at 5 percent) . . . . .	235.96	739.10
Net cost of operation . . . . .		<u>\$1 621.83</u>

at the beginning of the period. Repairs constituted 30 percent of the equipment cost; interest, 15 percent; and taxes, less than one percent.

#### MISCELLANEOUS EXPENSES

The miscellaneous expenses include insurance, taxes on stock, grinding farm feeds, registration, testing fees, veterinary fees, breeding fees, commissions, coal, salt, acid, medicine, dehorning, fly protector, whitewash, etc. They amounted to a total of \$4,876.04, or 8.6 cents per hundredweight of milk, and constituted 3.8 percent of the gross expense of milk production.

#### INTEREST ON VALUE OF LIVE STOCK

Interest includes the annual charge for the use of the capital in the form of live stock. The average inventory value in the present study was \$124,836.82; at 5 percent, the interest charge is \$6,241.84, or about 11 cents per hundredweight of milk.

#### BUILDINGS

The building charge includes insurance, depreciation, interest on capital invested, cash repairs, labor repairs, paint, rent for the water system, etc. The total charge for buildings usually constitutes from 8 to 10 percent of the value of the buildings and 5 percent of the net cost of milk production. In this study it amounted to \$4,563.65, representing 3.6 percent of the total gross expense.

## RETURNS TO THE DAIRY HERD

The returns to the dairy herd involve receipts from milk sold, milk used by the household, miscellaneous returns, and manure. All returns other than for milk are deducted from the gross expense.

### MILK

The milk sold represents three-fourths (75.2 percent) of the total income from the dairy herd.

During the period of this study 5,527,069 pounds of milk were sold and 156,923 pounds were consumed by the household. The total value of the milk sold and that consumed by the family was \$95,525.11. The average price received for all milk sold was \$1.68 per hundred-weight.

### STOCK

In using the herd as the basis of calculation, it must be borne in mind that the increase in the value of the young stock may be greater or less than the depreciation in the value of the milking stock, according to the policy of the dairyman. If it proves to be greater, as was the case in this study, then the net increase in the aggregate value of all the stock appears as an item of income.

In Table 11 is shown the stock transactions during the period of the study. During the year, 13 cows died and 281 cows were sold. This represents an annual turnover of 32 percent. During the same period 116 cows were purchased and 180 heifers freshened. The total increase in the value of the stock (\$18,231.73) constituted 14.73 per-

TABLE 11.—KINDS, NUMBER, AND VALUE OF STOCK USED IN THE PRODUCTION OF 5,683,992 POUNDS OF MILK (ETC.)

Kind of stock	Number	Total value
Cows and bulls at beginning of period.....	907	\$88 901.00
Cows bought.....	116	11 218.04
Heifers freshened.....	180	14 520.00
Two-year-old heifers at beginning of period.....	185	13 390.00
One-year-old heifers at beginning of period.....	251	12 340.00
Calves at beginning of period.....	311	8 745.07
Heifers bought.....	27	1 657.20
Calves bought.....	19	265.00
Original stock plus acquisitions.....	1 996	\$151 036.31
Cows and bulls at end of period.....	909	\$88 437.00
Cows and bulls sold during period.....	281	18 384.06
Heifers freshened in period.....	180	14 520.00
Two-year-old heifers at end of period.....	196	12 663.00
One-year-old heifers at end of period.....	268	14 692.00
Calves at end of period.....	293	10 505.57
Heifers sold.....	100	5 925.20
Calves sold.....	436	4 141.21
Final stock plus sales.....	2 663	\$169 268.04
Net increase.....	667	\$18 231.73



cent of the gross income from the dairy herds. In terms of milk, it amounted to approximately 32 cents per hundredweight.

It should be explained that the actual market value of the cows and bulls at the end of the period was \$4,283 greater than shown in Table 11, but as this amount was the result of appreciation in the general price level and not to appreciation in the value of the cows themselves, the cows were inventoried at the end of the period at the values prevailing at the beginning of the period.

### MANURE

The simplest method of calculating the value of the manure is to consider only the manure hauled from the barns to the fields. The total value of this manure, estimated at \$1 per load, amounted to \$9,440.10. The labor in hauling the manure is charged to the crops, and not to the stock. Manure dropped on pastures is not included in this valuation since ordinary pasture rentals of \$1 to \$2 per head per month assume the return of that amount of fertility.

### MISCELLANEOUS CREDITS

Miscellaneous credits form a very small part of the total returns from the dairy herds. The major items are sacks, bull service, hides, beef, and hauling. The total returns under this heading amounted to only \$572.27, which is but one cent per hundredweight of milk.

### NET HERD COST

The summary of the important factors of expense and of returns not milk are presented in Table 12. Feed is the most important item, constituting two-thirds (66.05 percent) of the gross expense. The feed cost per cow was \$96.85, or \$1.49 per hundredweight of milk, and the labor, \$24.91, or 38 cents per hundredweight of milk. Man labor constituted about one-sixth (16.99 percent) of the gross expense.

The total expenses other than man labor and feed, except pasture, aggregated \$.5016 per hundredweight of milk (horse labor, \$.0776; equipment, \$.0285; interest, \$.1098; buildings, \$.0803; pasture, \$.1196; and miscellaneous expense, \$.0858). The total returns not milk (stock, \$.3208; manure, \$.1661; and miscellaneous returns, \$.0100) aggregated \$.4969 per hundredweight of milk, an amount approximately equal to the total expenses other than man labor and feed, except pasture. The net cost of producing milk on these farms is then roughly equal to the sum of the man labor and the total feed exclusive of pasture.

In Table 13 is presented a summary of the man labor and of the feed, except pasture, involved in the production of the 5,683,992 pounds of milk.

TABLE 12.—SUMMARY OF TOTAL EXPENSE AND OF RETURNS NOT MILK INVOLVED IN THE PRODUCTION OF 5,683,992 POUNDS OF MILK (ETC.)

EXPENSES			
	Total	Percent of total	Per cwt. of milk produced
Feed other than pasture .....	\$77 758.26	60.74	\$1.3679
Pasture .....	6 795.52	5.31	.1196
Man labor.....	21 750.12	16.99	.3827
Interest on herd.....	6 241.84	4.88	.1098
Miscellaneous.....	4 876.04	3.80	.0858
Horse labor.....	4 408.79	3.44	.0776
Buildings.....	4 563.65	3.57	.0803
Equipment.....	1 621.83	1.27	.0285
Total.....	\$128 016.05	100.00	\$2.2522
RETURNS NOT MILK			
Appreciation of stock.....	\$18 231.73	.....	\$.3208
Manure.....	9 440.10	.....	.1661
Miscellaneous.....	572.27	.....	.0100
Total.....	\$28 244.10	.....	\$.4969
NET YEARLY HERD COST.....	\$99 771.95	.....	\$1.7553

TABLE 13.—AMOUNT AND VALUE OF MAN LABOR AND OF FEED, EXCEPT PASTURE, USED IN THE PRODUCTION OF 5,683,992 POUNDS OF MILK (ETC.)

	Value	Amount	Value per cwt. of milk	Amount per cwt. of milk
Man labor.....	\$21 750.12	137 792.25 hrs.	\$0.3826	2.42 hrs.
Grain.....	30 954.10	2 479 809.00 lbs.	.5447	43.63 lbs.
Silage.....	21 847.84	10 683 800.00 lbs.	.3843	187.96 lbs.
Hay.....	18 712.90	2 851 165.00 lbs.	.3292	50.16 lbs.
Other roughage.....	5 238.48	2 240 700.00 lbs.	.0922	39.42 lbs.
Miscellaneous feeds..	1 004.94	361 428.00 lbs.	.0176	6.36 lbs.
Total.....	\$99 508.38	.....	\$1.7506	.....

Owing to the fact that values are constantly changing, it seems necessary that results be expressed in terms of commodities whenever possible. The items of feed and man labor are most easily expressed in this way: man labor in terms of hours, and feed, except pasture, in terms of pounds. Since the feeds listed as miscellaneous<sup>1</sup> form a relatively small proportion of the total feed used, they may be disregarded in forming a simple, practicable, and comparatively accurate method for arriving at the approximate cost of milk production. For practical purposes the following amounts of feed, forage, and man labor represent the complete net cost of producing one hundred pounds of milk, and their use as a general formula offers a simple basis for computing the approximate year cost of milk production:

<sup>1</sup>See Table 7.

Grain.....	44 pounds	Hay.....	50 pounds
Silage.....	188 pounds	Other roughage.....	39 pounds
Man labor.....		2.42 hours	

In using these items as a basis for calculating the expense of producing one hundred pounds of milk, it is assumed that as the prices of feeds and labor rise or fall the other items of expense and return fluctuate more or less in the same proportion. For instance, equipment, buildings, interest, pasture, and miscellaneous expenses fluctuate in proportion to the value of manure, the increase in stock, and miscellaneous returns. Altho there is probably no time when they fluctuate in exact unison, they keep close enough together for practical purposes of computation. It is also assumed that the amount fed was not far from that which was physiologically most efficient under the prevailing conditions.

This method operates as follows: Assuming the value of grain to be \$55 per ton; hay, \$10 per ton; silage, \$6 per ton; and man labor, 25 cents per hour, we have:

Grain . . . . .	44 lbs.	@ \$55 per ton	= \$1.21
Silage . . . . .	188 lbs.	@ 6 per ton	= .56
Hay . . . . .	50 lbs.	@ 10 per ton	= .25
Other roughage . . . . .	39 lbs.	@ 6 per ton	= .12
Man labor . . . . .	2.42 hours	@ 25c per hour	= .61

Yearly herd cost of milk per hundredweight.....\$2.75

#### SEASONAL VARIATIONS IN THE COST OF PRODUCTION

The application of current values to the hours of labor and pounds of grain produces a result termed the "year cost" of milk production, which does not represent the cost at any one season of the year. A more or less satisfactory method of distributing the year cost over the various months is to use the relative percentage variations in the prices paid for milk during the different months of the year at the market to which the milk was delivered. The buyers of milk desire a constant supply thruout the year, and it may be assumed, therefore, that prices have been adjusted to stimulate the production of the desired amount each month of the year. The percentage variation by months, of the average annual Chicago price<sup>1</sup> of milk for the ten years 1907-1916, was as follows:

Month	Percentage variation	Month	Percentage variation
January.....	119.0	July.....	83.7
February.....	114.3	August.....	94.2
March.....	106.5	September.....	96.7
April.....	94.2	October.....	109.2
May.....	73.2	November.....	118.3
June.....	70.6	December.....	120.3

<sup>1</sup>Milk News.



It will be noticed that the December price is the highest, being 20.3 percent above the average price. The August price is 5.8 percent less than the average price. From December to June (the month of the lowest average) there is a variation of 49.7 percent.

If it is assumed that the year cost of milk production is \$2.75 per hundredweight, as shown on page 346, and the percentage deviations shown above are applied, the cost for January would be found to be \$3.27 per hundredweight ( $\$2.75 \times 1.19 = \$3.27$ ); the cost for August, \$2.59 per hundredweight ( $\$2.75 \times .942 = \$2.59$ ); etc.

The so-called monthly spread, monthly deviation, or monthly differential is based on the fact that a December price 20.3 percent above the average year price and a June price 29.4 percent less than the average year price, with the intervening months gradually approaching these extremes, produced in the past the desired volume of milk each month of the year, and therefore must have been somewhat commensurate with the cost.

## THE COW AS THE UNIT

When the cow is made the basis for calculating the cost of milk production, the cost of rearing young stock to mature cows is eliminated. There are eight items of expense taken into consideration; namely, feed, man labor, depreciation, horse labor, interest on value of stock, buildings, miscellaneous, and dairy equipment, and they are of importance in the order named. There are three items of return other than milk; namely, manure, calves, and miscellaneous.

The data used for this study are a part of the data obtained for the study pertaining to herd cost, but since some of the latter do not permit of a separation of cow feed from young stock feed, it is impossible to include all in the cow cost study.

## EXPENSES

### FEED

In the cost of maintaining a cow, feed is the most important factor. The farm-raised feeds involved in this study are charged to the cows at the prevailing farm values and not at the cost of their production. Purchased feeds are charged at actual market values. The man labor and horse labor required to deliver these commodities to the farms are charged under the items man labor and horse labor.

*Grain.*—The value of the grain fed the 446 cattle units involved in the production of the 2,924,164 pounds of milk constituted 39 percent of the total value of the feed used.

About 40 percent of the total grains were farm-raised. Of these, the value of the corn represents somewhat less than two-fifths of the

TABLE 14.—AMOUNT AND VALUE OF GRAIN CONSUMED BY 428 COWS AND 18 BULLS (446 CATTLE UNITS) IN THE PRODUCTION OF 2,924,164 POUNDS OF MILK CONTAINING 104,144 POUNDS OF FAT

Grain	Value	Weight in pounds	Value per cwt. of milk	Amount per cwt. of milk, in pounds
Corn.....	\$4 369.10	480 016	\$0.1494	16.4154
Malt.....	2 113.47	158 463	.0723	5.4191
Bran.....	961.08	75 179	.0329	2.5710
Gluten.....	715.69	46 873	.0245	1.6030
Cottonseed meal.....	704.00	43 388	.0241	1.4838
Ajax.....	631.39	37 993	.0216	1.2993
White Diamond.....	592.42	42 465	.0203	1.4522
Oil meal.....	474.80	27 470	.0162	.9394
Barley.....	402.65	30 606	.0138	1.0467
Oats.....	345.56	25 989	.0118	.8888
Hominy.....	253.71	18 797	.0087	.6428
Middlings.....	115.20	8 091	.0039	.2767
Victor.....	44.48	3 308	.0015	.1131
Sugar feed.....	44.41	3 617	.0015	.1237
Buckwheat bran.....	32.92	4 115	.0011	.1407
Purina.....	13.50	1 200	.0005	.0410
Buckwheat middlings....	9.60	600	.0003	.0205
Schumacker.....	9.09	625	.0003	.0214
Stock feed.....	9.00	200	.0003	.0068
Cottonseed hulls.....	7.48	2 607	.0003	.0892
Cowpeas.....	4.40	440	.0001	.0151
Molasses feed.....	2.39	111	.0001	.0038
Oat bran.....	.73	100	.0000	.0034
Total.....	\$11 857.07	1 012 253	\$0.4055	34.6169

value of the total grain feed. The value of the malt represents somewhat more than one-third of the value of the purchased grains. Thirty-five pounds of grain, costing 41 cents, were required to produce one hundred pounds of milk.

*Succulent Feeds.*—In Table 15 is shown the amount and value of the succulent feeds. The cost of these feeds constituted about one-fourth (25.9 percent) of the total cost of all feeds, and the cost of the silage represents more than nine-tenths of the total cost of the succulent feeds. Of the succulent feeds used per hundred pounds of milk produced, 9 pounds were green corn and 131 pounds were silage. The average cost of succulent feeds per hundredweight of milk produced was 27 cents.

TABLE 15.—AMOUNT AND VALUE OF SUCCULENT FEEDS USED IN THE PRODUCTION OF 2,924,164 POUNDS OF MILK (ETC.)

Succulent feed	Value	Weight in pounds	Value per cwt. of milk	Amount fed per cwt. of milk, in pounds
Silage.....	\$7 580.16	3 831 452	\$0.2592	131.0346
Green corn.....	385.00	265 000	.0132	9.0630
Total.....	\$7 965.16	4 096 452	\$0.2724	140.0976

*Hay.*—About one-fourth (22.2 percent) of the value of the total feeds used, was hay. The more important hays were alfalfa, clover, timothy, and mixed. About 36 pounds (35.7) were used in producing one hundred pounds of milk.

TABLE 16.—AMOUNT AND VALUE OF THE DIFFERENT KINDS OF HAY USED IN THE PRODUCTION OF 2,924,164 POUNDS OF MILK (ETC.)

Hay	Value	Weight in pounds	Value per cwt. of milk	Amount fed per cwt. of milk, in pounds
Alfalfa.....	\$3 307.89	428 363	\$0.1131	14.6491
Mixed.....	1 167.26	190 107	.0399	6.5012
Clover.....	1 141.82	214 895	.0391	7.3489
Timothy.....	1 087.32	176 881	.0372	6.0489
Oat and pea.....	85.43	15 623	.0029	.5343
Millet.....	28.57	9 524	.0010	.3257
Wild.....	20.80	9 000	.0007	.3078
Total.....	\$6 839.09	1 044 393	\$0.2339	35.7159

*Other Roughage.*—"Other" roughage constituted but 6.4 percent of the value of the total feed. In Table 17 are shown the amounts and values of these forages. Of the 29 pounds necessary to produce one hundred pounds of milk, 22 pounds were corn fodder and 7 pounds were straw. The total cost was 6.7 cents per hundred pounds of milk.

TABLE 17.—AMOUNT AND VALUE OF OTHER ROUGHAGE USED IN THE PRODUCTION OF 2,924,164 POUNDS OF MILK (ETC.)

Roughage	Value	Weight	Value per cwt. of milk	Amount fed per cwt. of milk, in pounds
Fodder.....	\$1 499.97	650 763	\$0.0513	22.2547
Straw.....	466.37	203 852	.0160	6.9713
Total.....	\$1 966.34	854 615	\$0.0673	29.2260

*Pasture.*—In Table 18 is shown the total value of each class of pasture used. Blue grass was by far the most important.

TABLE 18.—TOTAL VALUE OF PASTURE USED IN THE PRODUCTION OF 2,924,164 POUNDS OF MILK (ETC.)

Pasture	Value	Value per cwt. of milk
Oat stubble.....	\$ 14.00	\$.0305
Blue grass.....	1 750.33	.0599
Alfalfa.....	50.00	.0017
Clover.....	92.08	.0031
Cornstalk.....	61.45	.0021
Timothy.....	120.00	.0041
Total.....	\$2 087.86	\$.0714



*Feed Summary.*—The total feed involved represents over one-half (55.9 percent) the gross expense of producing the milk. In Table 19 is presented a summary of the amounts and values of the various feeds used. The total feed cost was \$1.05 per hundred pounds of milk.

TABLE 19.—SUMMARY OF ALL FEEDS FED TO 428 COWS AND 18 BULLS (446 CATTLE UNITS) IN THE PRODUCTION OF 2,924,164 POUNDS OF MILK CONTAINING 104,144 POUNDS OF FAT

Feed	Value	Weight	Value per cwt. of milk	Amount fed per cwt. of milk, in pounds
Grain.....	\$11 857.07	1 012 253	\$.4055	34.6169
Succulent feeds.....	7 965.16	4 096 452	.2724	140.0976
Hay.....	6 839.09	1 044 393	.2339	35.7159
Other roughage.....	1 966.34	854 615	.0673	29.2260
Pasture.....	2 087.86	.....	.0714	.....
Total.....	\$30 715.52	.....	\$1.0505	.....

### LABOR

Man labor and horse labor are important factors in milk production; in the present study they constituted nearly one-fourth (23.7 percent) of the gross expense. It will be seen from Table 20 that to produce the 2,924,164 pounds of milk, 69,098.25 hours of man labor were required. This is 2.36 hours (37 cents) per hundredweight of milk. One-half hour (.523) of horse labor was utilized in the production of one hundred pounds of milk.

TABLE 20.—AMOUNT AND VALUE OF LABOR USED IN THE PRODUCTION OF 2,924,164 POUNDS OF MILK (ETC.)

Kind of labor	Total value	Total hours	Value per cwt. of milk	Amount used per cwt. of milk, in pounds
Man labor.....	\$10 821.97	69 098.25	\$.3701	2.3630
Horse labor.....	2 207.65	15 289.75	.0755	.5229

### EQUIPMENT

In Table 21 is shown the various items involved in the equipment cost. It will be seen that the net cost of equipment constitutes a relatively small portion of the total cost of milk production.

Of the total equipment cost, depreciation represents 57.7 percent; repairs, 20.7 percent; interest, 21.0 percent; and taxes, 0.6 percent.

### BUILDINGS

The buildings necessary to house the 428 cows and 18 bulls constituted about 4 percent of the gross expense of producing the 2,924,164 pounds of milk.

TABLE 21.—COST OF DAIRY EQUIPMENT USED IN THE PRODUCTION OF 2,924,164 POUNDS OF MILK (ETC.)

Value of equipment at beginning of the period....	\$1 083.70	
New equipment.....	1 227.77	
Initial inventory and purchases.....		\$2 311.47
Value of equipment at end of period.....	\$1 871.40	
Equipment sold.....	236.75	
Final inventory and sales.....		2 108.15
Depreciation.....		\$203.32
Repairs.....	\$72.75	
Taxes.....	2.04	
Interest on average value of equipment (\$1,477.52 at 5 percent).....	73.88	148.67
Net cost of operation.....		\$351.99

## STOCK

In order to maintain milk production, it is necessary to continually change the milking stock. To maintain the herds on the farms studied at an average of 428 cows, 95 cows were sold, 45 cows were bought, and 66 heifers freshened. Eight cows which died during the time of the study represent about 2 percent of the average number of cows. The farmers aim to keep the cows as long as they are economical producers and try to dispose of them when they become unprofitable. The animals that were sold represent 22.2 percent of the total number involved. In other words, the average cow remained in the herd about 4.5 years.

TABLE 22.—NUMBER AND VALUE OF STOCK USED IN THE PRODUCTION OF 2,924,164 POUNDS OF MILK (ETC.)

	Number	Average value	Total value
Cows and bulls at beginning of period.....	443	\$98.14	\$43 476.00
Cows purchased.....	45	119.01	5 355.53
Heifers freshened.....	66	74.02	4 885.00
Total stock involved.....	554	\$96.96	\$53 716.53
Cows and bulls at end of period.....	451	\$94.66	\$42 692.00
Cows sold.....	95	67.85	6 445.48
Final stock plus sales.....	546	\$90.00	\$49 137.48
Depreciation.....	...	.....	\$4 579.05

## INTEREST ON VALUE OF LIVE STOCK

The interest on the capital invested in live stock (\$43,084.00) at 5 percent amounted to \$2,154.20, or 7.37 cents per hundredweight of milk.

## RETURNS NOT MILK

### MANURE

Manure represents about one-seventh of the total income to the dairy. The amounts included in these calculations are those hauled from the barn; they do not include manure dropped on pasture.

### CALVES

The 428 cows produced 363 calves, which number represents approximately 85 living calves for each one hundred cows. The casual observer would probably think that the cows should produce a larger percentage of living calves, but the failure of cows to breed and the losses from diseases, such as abortion, increase beyond the usual conception the expense of milk production.

### MISCELLANEOUS RECEIPTS

The miscellaneous receipts include hides, \$89.65; beef, \$37.60; bull service, \$6.00; feed for hogs following cows, \$11.25; milk hauling, \$54.50; and feed bags, \$47.30. They amounted in total to less than one cent (\$.0084) per hundredweight of milk.

## NET COW COST

Table 23 presents a summary of all the factors of expense and of income except milk, involved in the production of 2,942,164 pounds of milk from 446 cattle units.

From the above table it is seen that the value of the feed not pasture (\$0.9791 per hundredweight of milk) plus the value of man labor (\$0.3761) constituted 79.58 percent of the net cost of producing the milk (\$1.6953). In other words, the total value of the feed not pasture and the man labor falls short by 20.42 percent of representing the actual net cost of the milk. The reason for the lower proportion which feed and labor constitute by this method of calculation, as compared with the herd cost, lies in the elimination of the young stock from the records. It is of course an obvious fact that proportionately more feed would be required to produce one hundred pounds of milk when the feed given the young stock in the herd was included as a part of the cost of production, than when only the feed given the producing cows and bulls was included; and also, in a study confined to cow cost there is no appreciation in value of young stock to offset various other items of expense, as there is in a study in which the entire herd is included.

Table 24 shows in amounts as well as in value the man labor and feed except pasture involved in the production of the 2,924,164 pounds



TABLE 23.—SUMMARY OF ALL ITEMS OF EXPENSE AND OF RETURNS OTHER THAN MILK INVOLVED IN THE PRODUCTION OF 2,924,164 POUNDS OF MILK (ETC.)

EXPENSE			
Item	Amount	Percent of total	Per cwt. of milk
Feed not pasture.....	\$28 627.66	52.2	\$0.9791
Pasture.....	2 087.86	3.8	.0714
Man labor.....	10 821.97	19.7	.3701
Depreciation in value of stock.....	4 579.05	8.3	.1566
Horse labor.....	2 207.65	4.0	.0755
Interest on value of stock.....	2 154.20	3.9	.0737
Buildings.....	2 128.89	3.9	.0728
Miscellaneous.....	1 889.77	3.5	.0646
Equipment.....	351.99	.7	.0120
Total.....	\$54 849.04	100.0	\$1.8758
RETURNS NOT MILK			
Manure.....	\$3 943.88	.....	\$ .1349
Calves.....	1 089.00	.....	.0372
Miscellaneous.....	246.30	.....	.0084
Total.....	\$5 279.18	.....	\$ .1805
NET YEARLY COW COST.....	\$49 569.86	.....	\$1.6953

TABLE 24.—AMOUNT AND VALUE OF MAN LABOR AND OF FEED, EXCEPT PASTURE, USED IN THE PRODUCTION OF 2,924,164 POUNDS OF MILK (ETC.)

Item	Value	Amount	Value per cwt. of milk	Amount per cwt. of milk
Man labor.....	\$10 821.97	69 098.25 hrs.	\$0.3701	2.3630 hrs.
Grain.....	11 857.07	1 012 253.00 lbs.	.4055	34.6169 lbs.
Silage.....	7 965.16	4 096 452.00 lbs.	.2724	140.0976 lbs.
Hay.....	6 839.09	1 044 393.00 lbs.	.2339	35.7159 lbs.
Other roughage....	1 966.34	854 615.00 lbs.	.0673	29.2260 lbs.
Total.....	\$39 449.63	.....	\$1.3492	.....

of milk. On this basis the approximate cow cost of producing one hundred pounds of milk may be secured by adapting prevailing prices to the following quantities of feed and labor and dividing this amount by 79.58 percent or by adding 25.6 percent of the value:

Grain.....	35 pounds	Hay.....	36 pounds
Silage.....	140 pounds	Other roughage.....	29 pounds
Man labor.....	2.36 hours		

The use of these amounts presupposes that the prices of all items included change more or less in unison and also that the cost of each item not included fluctuates with some one of the items that is included: e. g., the cost of horse labor fluctuates with the price of feed; the depreciation of stock changes with the price of feed and labor; at the same time credits not milk, such as manure, change with the price of feeds. Altho these fluctuations never occur in exact unison,

they are never very far apart. Following is an illustration of how the formula may be used:

Grain . . . . .	35 lbs.	@ \$55 per ton	= \$0.96	
Silage . . . . .	140 lbs.	@ 6 per ton	= .42	
Hay . . . . .	36 lbs.	@ 10 per ton	= .18	
Other roughage . . . . .	29 lbs.	@ 6 per ton	= .09	
Man labor . . . . .	2.36 hours	@ 25c per hour	= .59	
				<hr/>
Add 25.6 percent of \$2.24 . . . . .				\$2.24 .57
Yearly cow cost of milk per hundredweight . . . . .				<hr/> \$2.81

For a discussion concerning seasonal variation in cost, the reader is referred to page 356.

## CONCLUSIONS

The cost of producing one hundred pounds of milk may be determined by computing either the cost of maintaining the entire herd or the cost of maintaining the producing stock alone.

• With the herd as the basis, the approximate year cost may be ascertained by applying current prices to the following amounts of feed and labor:

Grain . . . . .	44 pounds	Hay . . . . .	50 pounds
Silage . . . . .	188 pounds	Other roughage . . . . .	39 pounds
Labor . . . . .		2.42 hours	

With the milking stock as the basis, the approximate year cost may be ascertained by applying current prices to the following amounts of feed and labor and adding 25.6 percent to the value thus obtained:

Grain . . . . .	35 pounds	Hay . . . . .	36 pounds
Silage . . . . .	140 pounds	Other roughage . . . . .	29 pounds
Labor . . . . .		2.36 hours	

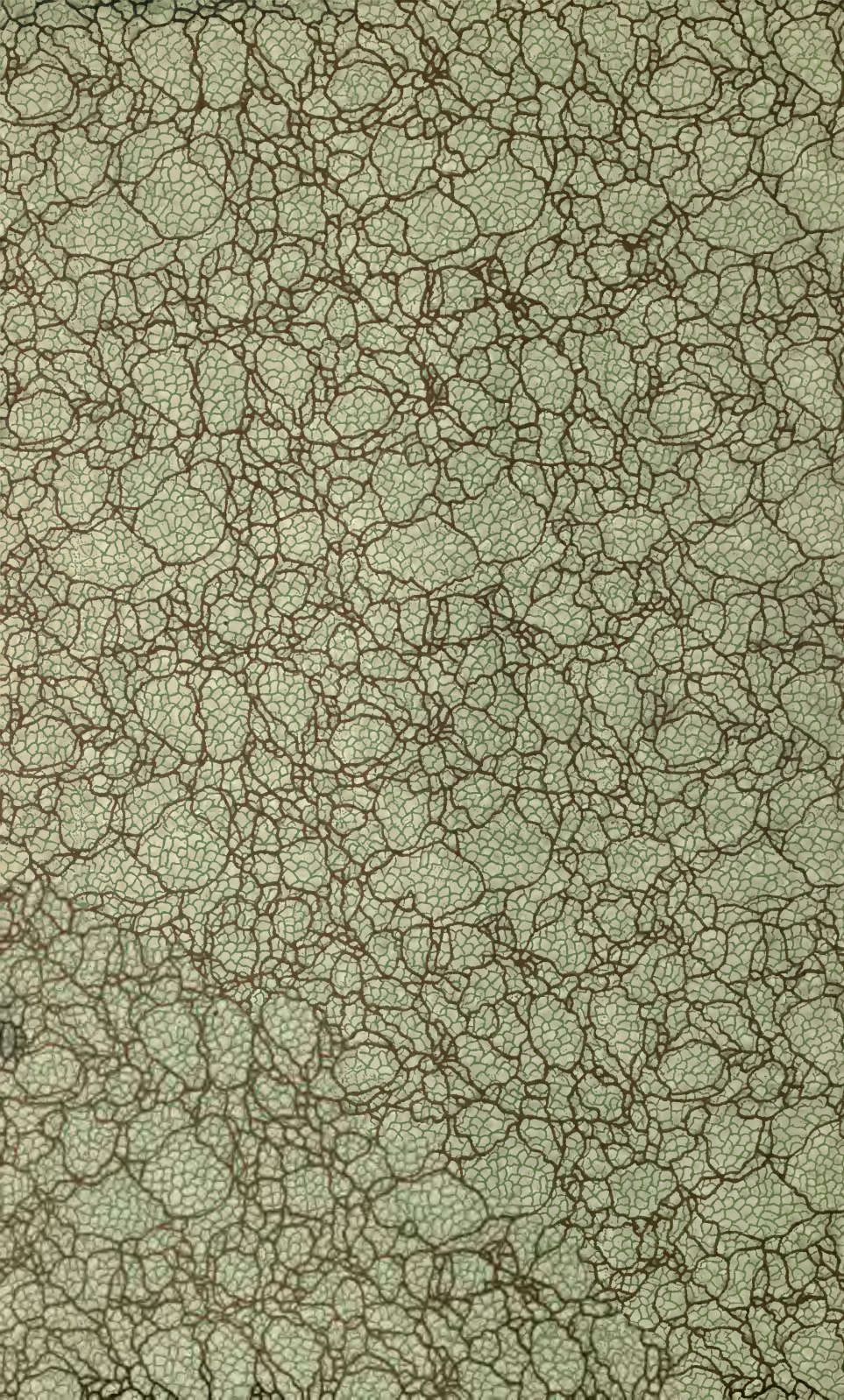
Of course when studies pertaining to costs are restricted to a comparatively small number of farms supplying a given market, certain limitations are placed upon the data which must be taken into consideration when applying the results to individual farms or to other districts. For instance, if high production and superior skill reduce the amount of labor necessary on the better farms, average farm wages should not be used in determining the labor cost, but rather the wages of the superior class to which the data are applicable. The same is true for feeds. Due cognizance must also be given to the ratio of winter milk to summer milk, for the cost of producing the former is much the greater. In the present study the lower cost of production resulting from the fact that better farms were involved tends to counterbalance the higher cost of the large proportion of winter production, but it is impossible to say with exactness which factor exerts the greater influence.



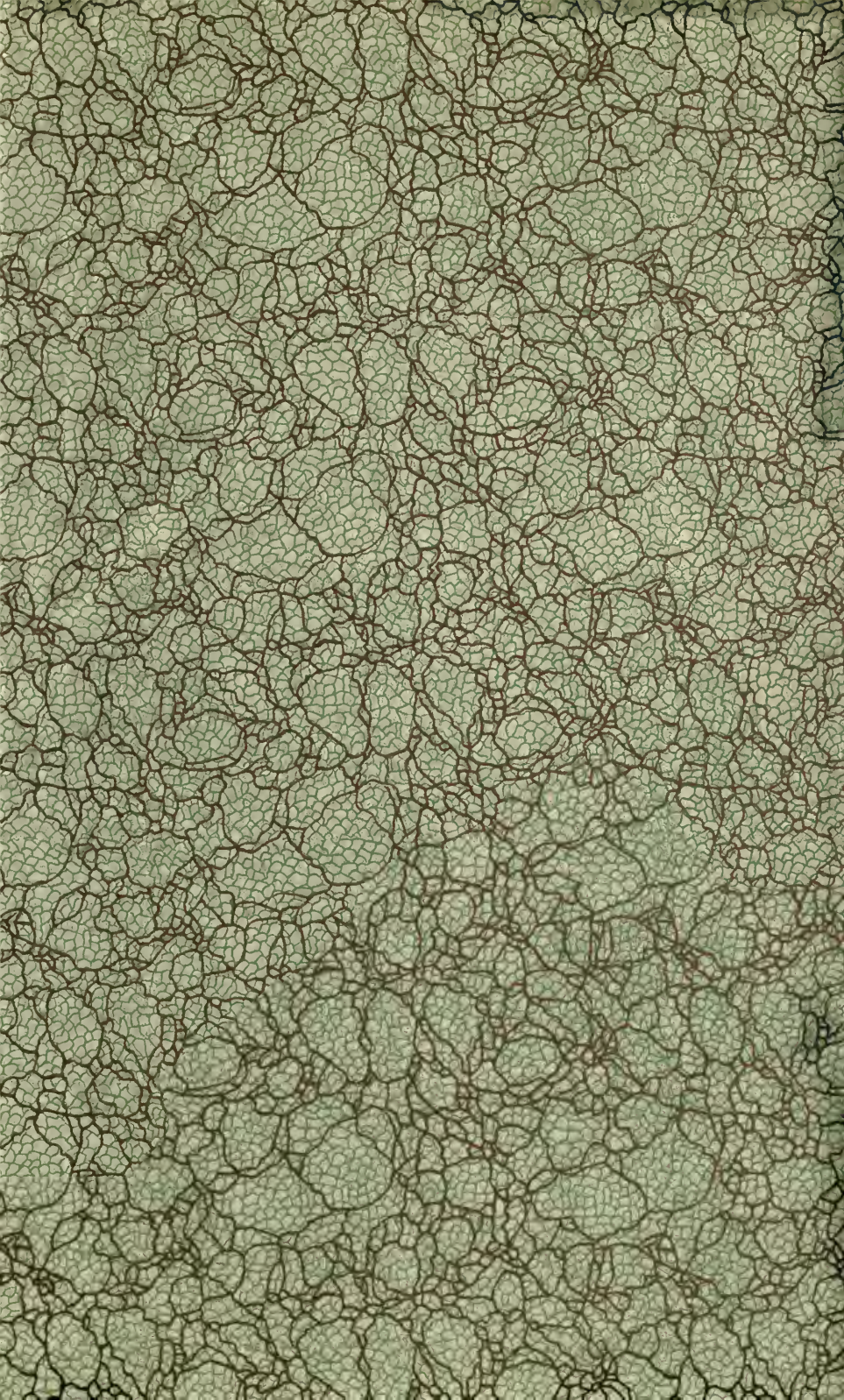












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